

damaged by washouts: very heavy rain caused flood at Yankton, carrying away railway bridges and tracks; 16th, local flood, doing considerable damage to low-buildings and railroad tracks at Toledo, O.; 19th, cloud-burst ten miles south of Yreka, Cal.; 20th, serious washouts on Union Pacific Railroad reported near North Platte; 21st, Nora Springs, Iowa, waterspout; 26th, waterspout on divide north of Colorado Springs, carried away bridges and caused serious washouts on railway: serious flood near Pittsburgh, swept away twenty-five buildings, (near Petrolia, Pa.,) several bridges and many miles of railway track; seven inches of rain reported from Irwin, Pa., estimated damage, \$300,000.

## RELATIVE HUMIDITY.

The percentages of mean Relative Humidity for the month range as follows: New England, 60 to 81; Middle Atlantic States, 60 to 80; South Atlantic States, 63 to 82; Gulf States, 57 to 79; Ohio-valley and Tennessee, 57 to 70; Lower Lakes, 64 to 70; Upper Lakes, 67 to 72; Upper Mississippi valley, 61 to 73; Lower Missouri valley, 67 to 71; Red River of the North valley, 72 to 75; Eastern Rocky Mountain Slope, 21 to 81; Rocky Mountain stations, 38 to 50; Western Plateau, 13 to 34; California, 33 to 78; Oregon, 61 to 65; Arizona, 27 to 43. *High stations* report the following averages, not corrected for altitude: Mt. Washington, 86.4; Pike's Peak, 50.7.

## WINDS.

The prevailing winds, at the Signal Corps stations, are shown by the arrows flying with the wind on chart No. II. The *maxima velocities* per hour have been given in the descriptions of movements of areas of low pressure.

*Total Movements of the Air.*—The following are the *largest* monthly movements in miles recorded at the Signal Corps stations:—Mount Washington, 20,152 miles; Cape Lookout, 13,200; Cape Hatteras, 11,129; Kittyhawk, 10,573; Dodge City, 9,725; Wood's Holl, 9,407; Pike's Peak, 9,239; Indianola, 8,949; Sandy Hook, 8,713; Smithville, 8,694; Cape May, 8,268; Breckenridge, 7,586. The *smallest* movements are:—La Mesilla, 1,593 miles; Tucson, 1,806; Nashville, 1,911; Silver City, 1,941; Florence, 2,039; Lynchburg, 2,199; Indianapolis, 2,634; Augusta, Ga., 2,755; Olympia, 2,785; Morgantown, 2,810; Cairo, 2,886.

*Local Storms.*—During the month local storms have been numerous and occasionally quite severe. Those notable for *heavy rain* or *hail* will be found under the respective headings. The following is a summary of those accompanied by high or destructive winds: On the 2nd severe local storms occurred in Dakota, Minnesota, Iowa and Wisconsin, preceding low pressure area No. I, as follows: At Elkhorn, D. T., 5.30 p. m., tornado from SW. to SE. in circular course, destroying buildings, &c; the storm in Goodhue Co., Minn., Wednesday night and Thursday morning (2nd—3rd) seemed to start four miles beyond Vasa, the place of greatest destruction, and traveled toward the SW., nine persons killed and thirty injured; at Lake Emily five persons injured, considerable stock killed, granary lifted from foundation and carried 80 feet distant—storm crossed the Mississippi river at Red Wing into Pierce Co., Wis.; at Warrenton a "house was carried away, and four persons who were in it were drowned while attempting to escape, the house being flooded several feet deep;" persons were killed by lightning at Winnebago and Mountain Lake, and "every town in S. and E. part of Wisconsin suffered severely;" a "terrible" wind storm is also reported in northern part of Plymouth Co., Iowa, between 6 and 7 p. m., destroying houses and killing two men; the storm cloud was observed from Lemars, and is described as "having the appearance of an hour-glass, after which it assumed a straight column, and then seemed to break into fragments and drift away; it was in sight about half an hour. On the 6th "violent" NW. wind storm at Logansport, Ind. On the 10th and 11th severe storms accompanied low area No. III in Michigan, Ontario, Ohio, Pennsylvania, New York and Maryland as follows: 11th, Thornville, Lapeer Co., Mich., "hurricane," many buildings demolished, and in adjoining town two persons killed; at Port Huron "heaviest wind ever recorded here; numerous buildings unrooted and trees blown down, all lying from W. to E.; Sardinia, Ontario, noon, terrific storm, "apparently from across the river, in the direction of Port Huron, lasting 15 minutes, doing much damage to buildings and crops;" Sandusky, max. vel. of wind for 10 minutes, 72 miles per hour; Logan Co., Ohio, perfect hurricane in southwestern part of county, buildings damaged and stock killed, track seven miles wide and ten long, one man killed by lightning; Maumee valley, much damage to houses and trees; Erie Co., destructive storm at 3 p. m., lasting five minutes, reported to have alternately touched the ground and then to leave it for a while, general direction of storm towards the southeast, fallen trees generally lying in that direction, but some lying toward the NW.—an observer to the north of the storm states "that a funnel-shaped cloud descended to the ground, rested a moment, and then bounded off; its general appearance was a heavy bank of clouds, reaching to the surface of the ground;" in the Juniata valley, Pa., a storm doing much damage; most destructive at Mifflin, one person killed; at Lewistown buildings were blown down. On the 13th, heavy storms are reported to have visited Wrightsville and Hawkinsville, Ga., demolishing buildings, &c. On the 14th, during passage of low area No. IV at Niagara Falls, N. Y., "severe local storm, injuring buildings and trees," and at Wells River, Vt., 5.45 p. m., "violent hail-storm and tornado" lasting fifteen minutes. On the 15th, accompanying low area No. V, severe storms in various parts of Ontario during afternoon, doing great damage to buildings and crops; Montreal, Can., night, severe thunder-storm, one person killed; Binghamton, N. Y., violent storm, one person killed, also one person killed at Skaneateles Falls by lightning. On the 16th, accompany-

ing same depression, very severe storms occurred over New York and New England, which were most destructive in a belt of country including the Mohawk and upper Hudson valleys, Massachusetts and Connecticut. They appear to have commenced in the Mohawk valley, about 1 p. m., where "a violent hurricane," seemingly about fifteen miles wide, passed over Herkimer, Fuller, Montgomery, Schenectady, Albany (2 p. m.) and Rensselaer counties, devastating orchards and leveling grain crops: a "violent storm" commenced at Coxsackie, Greene county, at 2:30 p. m.; Kingston and Saugerties, Ulster county, 4 p. m., "tornado," crops ruined, barns demolished, ice fell in large chunks." In *Connecticut*, at Shelton, "heavy storm," two men killed and two injured by lightning; off Long Island, boat capsized and two men drowned. *Massachusetts*—Pittsfield, 2:30 p. m., "tornado from west, three persons killed and four injured, buildings unroofed and blown down, storm took a course from NW. to SE., following along the valley, track not over sixty rods wide, in which hundreds of trees were leveled and buildings demolished;" Laconboro', immense hail-stones, seven inches in circumference, great damage to crops, one person killed; West Stockbridge, one person killed; Springfield, 3:15 p. m., heavy storm; Northampton, 3 p. m., terrible storm, buildings and trees demolished, fearful wind, followed by heavy rain; Fitchburg, 3:35, "tornado, lasting three minutes," much damage to buildings and trees; Boston and vicinity, 4:17 p. m., severe wind and hail-storm, houses unroofed and one man killed; at Hull, captain of schooner washed overboard and drowned; off Baker's Island, sloop capsized and all on board drowned; off Salem, boy washed overboard and drowned; at Paddock's Island, man drowned; at Dover, town hall demolished and one man killed; at Brookline, church and town hall badly damaged; on Bird's Island flats, yacht capsized and six persons drowned; off Scituate, two boats capsized and three persons drowned; at Newton, trees uprooted and houses badly damaged; South Braintree, houses demolished and two persons injured; Lawrence, Essex county, storm began at 4 p. m., NW. gale for fifteen minutes. Taunton, Bristol co., 5:30 p. m., storm lasting five minutes, followed by two hours severe NW. gale. Nantasket, Norfolk co., "hurricane struck here at 5:30 p. m.," buildings demolished and six persons injured; near Governor's Island, two yachts capsized and five persons were drowned. In all thirty persons were drowned on that day in and around Massachusetts bay. Woods Holl, "tornado" or squall from 5 to 5:30 p. m. *Rhode Island*—Newport, between 5 and 6 p. m. "terrible storm of wind, rain and hail." Off Montauk Point, L. I., schooner Annie and Millard struck by lightning during heavy thunder-shower during Wednesday night. Schooner Agnes parted chains in Hamstead Harbor, L. I. Schooner Harriet Lewis, parted chains in Dutch Island Harbor, and several vessels lost sails and topmasts in Long Island Sound. On the 17th terrific thunder-storms, with heavy rains were reported in northeastern part of Texas, near Jefferson two horses were killed by lightning, and at Kildare a house was struck and one person killed; Chattanooga, Tenn., heavy storm, houses blown down; Portsmouth, Va., one person killed by lightning. On the 18th, off Point aux Trembles, 21 miles from Quebec, shortly before 9 p. m., yacht capsized and eight persons drowned. On the 23rd, accompanying low-area No. VI., at Smith Falls, Ontario, terrific thunder-storm, one person killed; Oakland, Ky., destructive wind-storm over northern section of county. On the 20th, accompanying low area No. VII., at Pittsburgh, Pa., a very violent storm of wind, with heavy rains, producing floods in the Youghiogheny, Monongahela and Alleghany valleys; at Philadelphia, Pa., heavy storm, houses unroofed. On the 28th, at Ft. Wallace, Kansas, a "violent NW. wind," and at McKinney, Tex., evening, "tornado" from the N., demolishing a church. 29th, Corsicana, Tex., "tornado" from west to east. 30th, Syracuse co., N. Y., "tornado" in southwestern part of county at 3 p. m., track three miles wide and ten miles long, lasting twenty minutes, deluge of water, crops much damaged.

## VERIFICATIONS.

*Indications.*—The detailed comparison of the tri-daily weather indications for June with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of omissions to be 1.41 per cent, and of verifications to be 85.1 per cent. The percentages for the four elements have been, Weather, 97.3; Direction of the Wind, 87.0; Temperature, 82.4; Barometer, 87.3. The percentages of verifications by geographical districts have been: New England, 83.9; Middle States, 89.1; South Atlantic States, 82.3; East Gulf States, 80.8; West Gulf States, 82.5; Lower Lake region, 87.7; Upper Lake region, 86.3; Tennessee and the Ohio valley, 82.4; Upper Mississippi valley, 87.6; Lower Missouri valley, 85.0; Northern Pacific coast region, 91.7; Central Pacific coast region, 100; Southern Pacific coast region, 100. Of the 3,813 predictions that have been made, 149, or 3.91 per cent, are considered to have entirely failed; 116, or 3.04 per cent, were one-fourth verified; 423, or 11.09 per cent, were one-half verified; 457, or 11.99 per cent, were three-fourths verified; 2,614, or 68.55 per cent, were fully verified, so far as can be judged from the tri-daily weather maps.

*Cautionary Signals.*—98 Cautionary Signals were displayed during the month, of which 82, or 83.7 per cent., were justified. No Cautionary Off-shore Signals were displayed. The above does not include signals ordered at 47 display stations where the velocity is only estimated and not measured.

## NAVIGATION.

*Stage of Water in Rivers.*—In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Corps river gauges for the month, with the dates. With one exception (Omaha from the 1st to the 4th) the rivers at the Signal Corps stations have not reached the danger line during the month. The Red River at Shreveport and the Missouri at Yankton, Omaha and Leavenworth have continued to fall slowly throughout. The Mississippi has fluctuated considerably but continued in a good